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(54) Abstract Title
Refuse vehicle engine control

(57) A refuse vehicle comprises an engine 20 for driving the vehicle, a pump 26, driveable by the engine 20 for supplying fluid to fluid-operable equipment 28, 32, 34, 40 on the vehicle, and an electronic controller 44 for controlling the speed of the engine 20. The controller 44 is arranged to maintain a given engine speed in response to power demand of the equipment. If the vehicle is stationary when the fluid operable equipment is operated, neutral may be selected in the transmission. The engine speed may be limited to minimum and maximum speeds when the vehicle is bing driven and the equipment is operating. An immobiliser switch such a keypad may be fitted, and a warning may be given and the engine may be shut down, optionally after a short idling period, when changes of parameters such as engine temperature and/or oil pressure are detected.

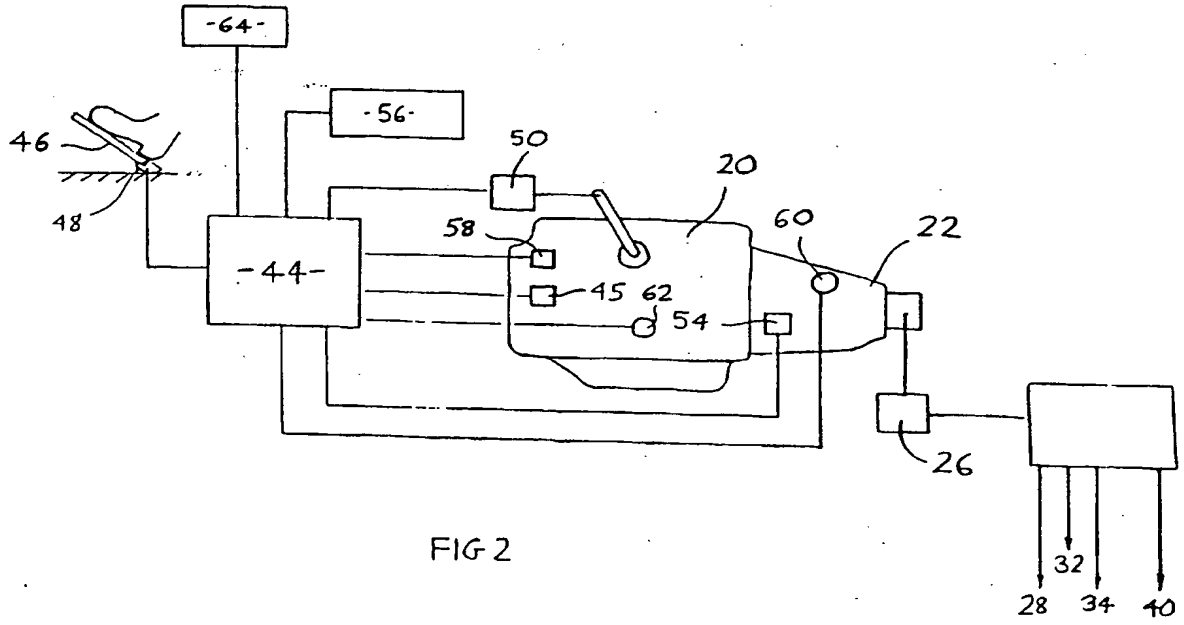

FIG 2

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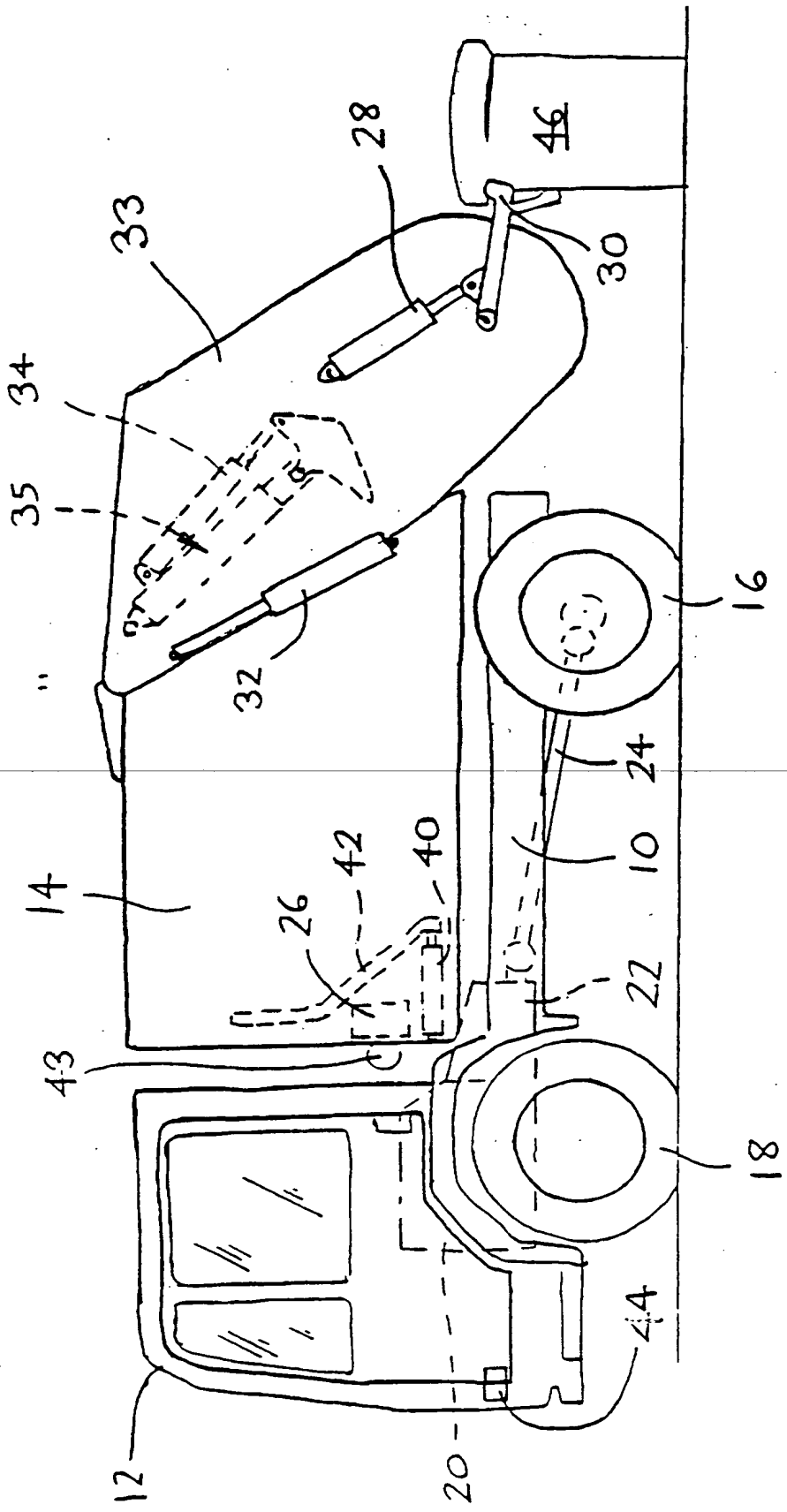

FIG 1

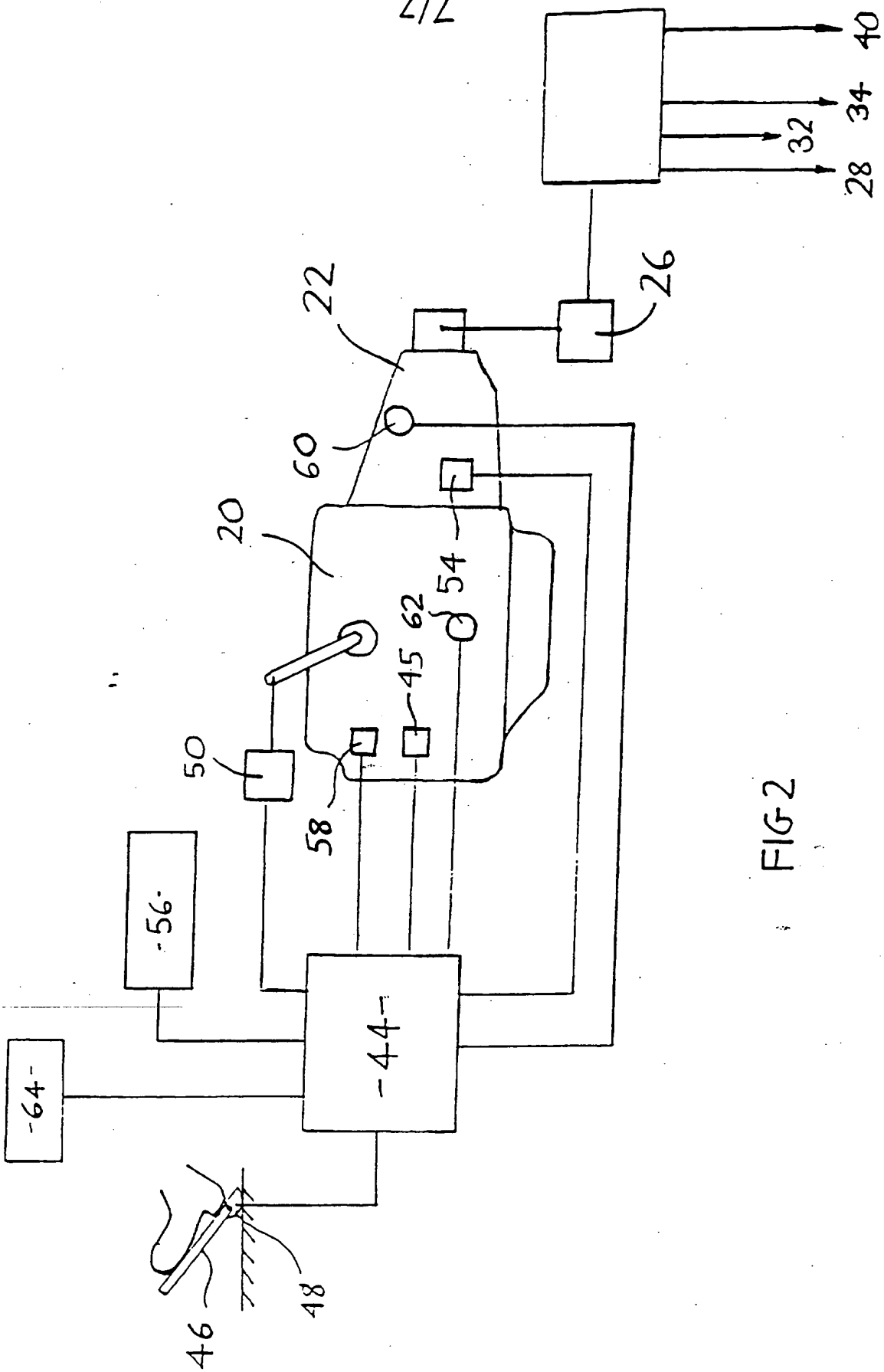

FIG 2

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REFUSE VEHICLE ENGINE CONTROL

The invention relates to a refuse vehicle engine control and is primarily concerned with the control of the prime mover of the vehicle in response to the demand of fluid operable equipment on the vehicle.

It has been known for some time to use the prime mover of a refuse vehicle to drive a hydraulic pump which supplies hydraulic fluid to equipment on the vehicle. This equipment may include a lifter for raising and tipping a container so that its contents are deposited into a hopper on the rear of a large capacity storage body on the vehicle, a compaction system in the hopper, a packer for packing the deposited refuse towards the front end of the body, a ram arrangement for lifting the hopper to open the rear of the storage body and an ejector for ejecting the refuse out of the open end at a disposal point.

The power required to drive the hydraulic equipment varies during operation of the vehicle depending upon which item of equipment is being operated and the forces involved. For example, power necessary to drive the lifter will be dependent upon the weight of the refuse bins concerned. Similarly, the power required to drive the packer will depend upon the nature of the refuse within the storage body. At the present time, the vehicle engine is initially set to run at a speed higher than is needed to cater for the power required by the equipment. Whilst that ensures that the pump will always power the equipment fully whatever the demand, the engine is mostly running on a speed higher than necessary which is undesirable from the point of view of fuel consumption, noise and the environment.

An object of the present invention is to provide a control arrangement for the engine which will reduce the foregoing disadvantages.

According to the invention, there is provided a refuse vehicle comprising an engine for driving the vehicle, a pump driveable by the engine for supplying fluid to fluid-operable equipment on the vehicle and control means for controlling the speed of the engine, the control means being arranged to maintain a given engine speed in response to power demand of the equipment

With such an arrangement, the engine will be controlled so as to run at a constant speed which is appropriate for powering the equipment. In that way the problem of the engine being run at speeds much higher than necessary is avoided.

Preferably, a driver operable throttle control for the engine includes a sensor and the control means preferably senses the position of the throttle. Preferably, the control means operates an actuator for controlling engine speed in response to the throttle particularly when the vehicle is being driven along the road.

When the vehicle is stationary, for example to receive refuse, an automatic transmission on the vehicle through which drive is transmitted to road wheels will be in a neutral condition. Normally, the set engine speed in neutral will be less than the given engine speed selected for powering the fluid operable equipment on the vehicle. However, once power is demanded from any item of the equipment, the control means preferably senses the power demand and causes the engine speed to reach the aforesaid given

peed to power the equipment. While the transmission remains in neutral, any attempt by the driver to increase engine speed further by using the throttle will not succeed.

Once the transmission is operated to select a drive ratio, the control means preferably operates to enable the driver of a vehicle to control engine speed via the throttle, once again.

If refuse is being compacted while the vehicle gearbox is in 'Drive', the control means preferably senses movement of the vehicle and sets a minimum and/or maximum speed that the engine can be driven. Where a minimum speed is set, that minimum speed will ensure that the engine will not stall in normal circumstances. Any maximum speed is set bearing in mind fuel consumption and noise.

If desired, the control means may set a maximum road speed for normal driving, e.g. 85 km/hr. If required, a secondary road speed limit, for example 20 km/hr. may be selectable for use when moving incrementally along the road during a refuse loading mode.

The control means may be arranged to shut the engine down where, for example. there is loss of engine oil pressure and/or the temperature of engine cooling water or transmission oil rises to an excessive level. Prior to engine shutdown, a visual and/or audible display may be given to the driver for a short period of time to provide prior warning. For example, there may be an intermittent display and audible warning for a given period of time such as 10 seconds followed by a continuous display and audible warning for a further period of time such as 15 seconds. The engine may then idle for a

iort period prior to final shutdown. Should the engine be re-started before the fault has been rectified, the above sequence is preferably re-run.

A display unit, such as an electronic LED or LCD unit, may be fitted in the cab visible to the driver. The electronic display unit may display messages such as OIL PRESSURE LOW, GEARBOX OIL TEMPERATURE HIGH. HYDRAULIC OIL OVERHEATED, WATER TEMPERATURE HIGH.

An immobiliser switch such as a keypad may be provided for the vehicle, incorrect operation of which keypad will be sensed by the control means and will prevent the vehicle being driven.

A refuse vehicle in accordance with the invention will now be described by way of example with reference to the accompanying drawing in which:

Figure 1 is a diagrammatic representation of a vehicle in accordance with the invention.

Figure 2 is a diagrammatic representation of a control system of the vehicle.

A vehicle comprises a chassis 10 supporting a cab 12 and a high capacity storage body 14 for refuse. The chassis 10 has rear wheels 16 and steerable front wheels 18. An engine 20 is mounted on the chassis in known manner and supplies power to the rear wheels 16 via an automatic gearbox 22 and a propeller shaft 24.

hydraulic pump 26 is suitably driven by the engine 20 and supplies hydraulic fluid to rams 28 for operating refuse bin lifters 30, rams 32 for raising a hopper 33, rams 34 for operating a compaction system 35, and one or more rams 40 for operating an ejector 42. All such hydraulic equipment is well known on refuse vehicles such as the "Phoenix" vehicle available from Dennis Eagle, Warwick, England. The various rams 28, 32, 34, 40 are connected to the pump 26 via controls 43 of a kind known on such vehicles and which are not described herein.

An electronic controller 44 is provided for sensing the rotational speed of the engine 20 via a sensor 45 and for providing a signal for controlling the engine speed, via a throttle actuator 50, as shown in Fig 2.

In use, the engine 20 is set by the controller 44 to maintain a given speed (for example 1200 rpm) generally suitable for driving the pump 26 at a speed sufficient to power the various rams. When, say, a refuse bin (indicated at 46) which is particularly heavy is loaded onto one of the lifters 30, load on the lifter rams 28 may cause a fall in engine speed as increased power demand is placed on the pump 26. The controller 44 senses the fall in engine speed and causes the engine speed to increase back to its given speed so that the pump 26 can deliver the power required to operate the lifter rams 28. When the refuse bin 46 has been emptied, the power requirement reduces and, therefore, the engine speed will tend to increase. The controller 44 senses the increase in engine speed and causes the speed to be brought back to the given speed.

Looking at figure 2, a throttle pedal 46 in the cab 12 is operable by the driver of the vehicle. The throttle pedal 46 includes a position sensor 48 which

ovides a signal for the controller 44. In response to the signal from the sensor 48, the controller 44 operates the throttle actuator 50 to control rotational speed of the engine 20. The gearbox 22 incorporates a sensor 54 which senses when the gearbox 22 is in a neutral position. When the sensor 54 indicates that the gearbox 22 is in a neutral condition, the controller 44 sets the throttle actuator 50 so as to drive the engine 20 at a set speed, for example 800 rpm. With the gearbox 22 in neutral, operation of the throttle pedal 46 by the driver will have no effect on engine speed when the hydraulic system is in operation. Where, for example, bins 46 have been placed on the lifters and a power demand is made to enable the bins to be emptied into the hopper 33, the power demand will cause the engine speed to decrease and the changing speed will be sensed by the controller 44. The controller 44 will then cause the throttle actuator 50 to increase the engine speed to the aforesaid given speed to enable the pump 26 to deliver sufficient power to drive the lifters 30. As mentioned above, once the power demand decreases and there is a resulting increase in engine speed, the controller senses the increase and causes the speed to be brought back to the given speed.

The controller 44 can be programmed to set a maximum road speed for normal driving. In that way, it is impossible for the vehicle to be driven at a speed which is illegal. If desired, the controller 44 may also be programmed to set a secondary, lower, road speed. For example, where the vehicle is being driven incrementally along a road between pick-up points for refuse bins, with a loader on a step at the rear, the fixed secondary low speed can be useful. Such a fixed low speed saves the driver of the vehicle from trying to maintain a suitable speed by fine control of the throttle pedal 46. Once the throttle pedal is depressed the vehicle will not exceed the secondary speed

:gardless of throttle position. An electronic display unit 56 is provided in the cab 12 so as to be visible to the driver and may display messages as set out hereinbefore. The display may be of an electronic LCD or LED type.

The controller 44 may be connected to a temperature sensor 58 on the engine for sensing coolant temperature, a sensor 60 on the gearbox 22 for sensing transmission oil temperature and to a pressure sensor 62 for sensing oil pressure in the engine 20. Where excessively high temperatures are sensed by the sensors 58, 60 or if the oil pressure falls below an acceptable level, the controller 44 is arranged to provide a display on the unit 56 to the effect that the engine is about to be switched off. In order to draw attention to the driver, the display may be intermittent over a period of time such as 10 seconds. Thereafter, the intermittent display may become continuous for a further period of time such as 15 seconds. After that, the engine may idle for a short period prior to the controller 44 switching off the engine. The visual display may be accompanied by a suitable audible warning. Until the fault has been rectified, the foregoing display sequence will be repeated after a short period of time if the driver re-starts the engine.

For vehicle security purposes an immobiliser switch such as a keypad 64 is provided in the cab 12 for operation only by personnel given the correct sequence of keypad digits. Until the correct sequence has been keyed-in, the controller 44 will prevent the engine 20 being started.

CLAIMS

1. A refuse vehicle comprising an engine for driving the vehicle, a pump driveable by the engine for supplying fluid to fluid-operable equipment on the vehicle and control means for controlling the speed of the engine, the control means being arranged to maintain a given engine speed in response to power demand of the equipment.

2. A refuse vehicle according to claim 1, in which the control means controls the engine so as to run at a constant speed which is appropriate for powering the equipment.

3. A refuse vehicle according to claim 1 or claim 2, in which a throttle control is provided for the engine operable by the driver of the vehicle, the throttle control including a sensor which enables the control means to sense throttle position.

4. A refuse vehicle according to any preceding claim, in which the control means operates an actuator for controlling engine speed in response to the driver operable throttle control.

A refuse vehicle according to any preceding claim, in which the vehicle includes a drive transmission for transmitting drive from the engine to road wheels such that with the fluid operable equipment in use with the vehicle stationary, a neutral condition is selected in the transmission.

6. A refuse vehicle according to any preceding claim wherein once power is demanded from any part of the fluid-operable equipment, the control means senses the power demand and causes the engine speed to reach the aforesaid given speed to power the equipment.

7. A refuse vehicle according to claim 5 or to claim 6 when appendant to claim 5, wherein a drive ratio can be selected in the drive transmission following use of the fluid-operable equipment and the control means enables engine speed to be controlled once again by means the driver-operable throttle control.

8. A refuse vehicle according to any preceding claim, in which the control means senses movement of the vehicle and sets a minimum and/or maximum speed at which the engine can be driven.

A refuse vehicle according to claim 8 and where a minimum speed is set, in which the minimum speed will ensure that the engine will not stall in normal circumstances.

10. A refuse vehicle according to any preceding claim, in which the control means is arranged to shut down the engine upon sensing a certain change of parameter such as engine temperature and/or oil pressure.

11. A refuse vehicle according to claim 10, in which, prior to shutdown, a visual and/or audible signal is given to warn of imminent shutdown.

12. A refuse vehicle according to claim 11, in which the engine is arranged to idle for a short period prior to shutdown.

13. A refuse vehicle according to any of claims 10 to 12, and where the engine has been shut down, in when the control means will repeat the shut down should the engine be re-started before the change of parameter has been rectified.

14. A refuse vehicle according to any preceding claim, in which an immobiliser switch such as a keypad is provided for the vehicle, incorrect

)peration of which is sensed by the control means and prevents the vehicle from being driven.

15. A refuse vehicle as substantially described herein with reference to the accompanying drawings.

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Claims searched: 1-15

Examiner: Dave Mobbs
Date of search: 30 July 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Int Cl (Ed.6): B65F 3/00; F02B 63/06; F02D 29/04.

Other: ONLINE: EPODOC, JAPIO, WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	GB 2,296,693 A	(MARKS)	1-7, 10, 11, 13, 14.
Y	GB 2,272,021 A	(MOULDING)	14.
X	GB 1,439,193	(SMITH)	1-4 and 6.
Y	EP 0,791,737 A	(K. K. KOBE SEIKO SHO)	1-7.
Y	JP 07158493 A	(HITACHI CONSTRUCTION MACHINERY CO. LTD.) - cited from the abstract.	10, 11, 13.
Y	SU 1,638,339 A	(UNIV PATRIS LUMUMBA) - cited from the abstract.	10, 11, 13.

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